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中国新发現的鱷类化石*

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自1948年本文作者发表了有关我国鱷类化石的論文以后，关于这一类化石的記載迭有增加。最近在广东南雄发現了一些鱷类化石，而在部分地区同許多龚化石共生。这一发現特别重要，因为根据所获哺乳动物化石的研究，这些化石的时代可能为古新世。另外在內蒙古伊克昭盟鄂克托旗的两地方，也找到了鱷类化石，时代为白堊紀。这些材料在本文加以研究和討論。

新种的描述与討論

鱷科 Crocodilidae Kaelin, 1955; non Cuvier, 1807

鱷亚科 Crocodilinae Kaelin, 1955

亚洲鱷属 *Asiatosuchus* Mook, 1940

南岭亚洲鱷(新种) *Asiatosuchus nanlingensis* sp. nov.

材料：正型标本，一对下顎骨，左側者保存較完全。若干零碎的脊椎骨和四肢骨。广东南雄湖口西北約两公里。野外号6228，本所化石編号为 V. 2773。

附加标本，具有縫合綫部的一对下顎骨部，另一右下顎骨、一破碎下顎，若干破碎脊椎骨与四肢骨。广东南雄湖口西約一公里，野外号6227。本所化石編号为 V. 2772。

一右下顎的关节部分，广东南雄县城西約4公里，野外号6217。所內編号为 V.2775。

一破碎下顎骨。广东南雄修仁东約1公里，野外号6219。本所化石編号为 V.2721a。

层位与地点：?古新統。地点分别見上。

特性：和谷氏亚洲鱷很相似，但更为碩大。牙齿数为19—20，比前者多一些。下顎前部的后端微有收縮，下顎孔特小。

描述：以上所列举的标本，大部破碎。比較好一些的为6228和6227下顎骨。我們的研究主要是根据这些材料。所有脊椎骨、下顎骨和其他可以鉴定的骨骼，在构造上和大小上都很协調，甚至化石的顏色，都为灰白色。归于同一种毫无問題。附着的岩石为通常标准的紫色砂质泥土。

正型标本：6228地点的一对下顎，均不完全，也不連在一起，但很可能归之于一个个体。另外一段破的右下顎，可能归之上述的右下顎，但找不到直接的接合部分。左下顎的前部保存較完全一些。附有7个牙槽，包括3个破了的牙齿(图1—2)。

两个下顎和莫克所描述的谷氏亚洲鱷很相近，只是大一些。顎骨孔非常小而窄。骨

* 2月12日收到。

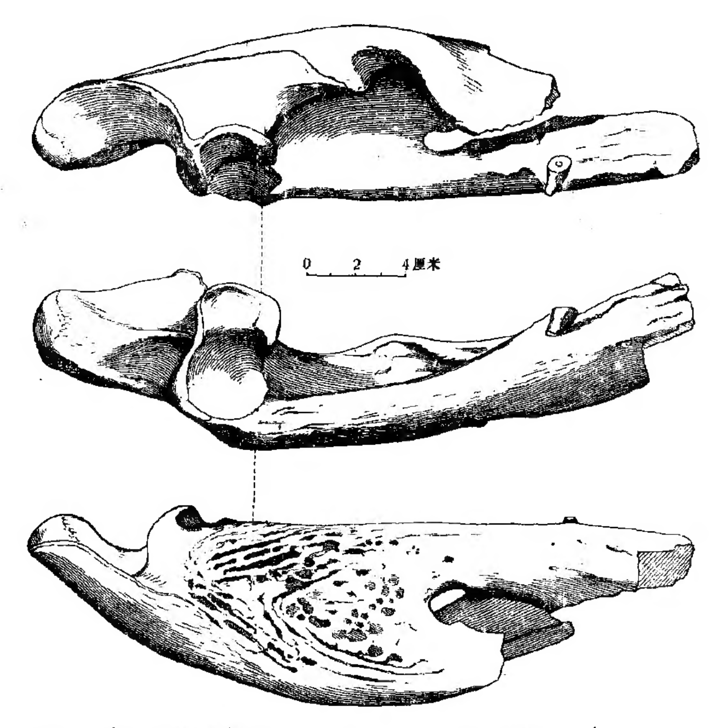


图 1　南岭亚洲鳄(新种)左下颚上视，外视及下视　1/3 原大。
Fig. 1. *Asiatosuchus nanlingensis* sp. nov. Left lower jaw in Upper ,outer and lower views. 1/3 nat. size.

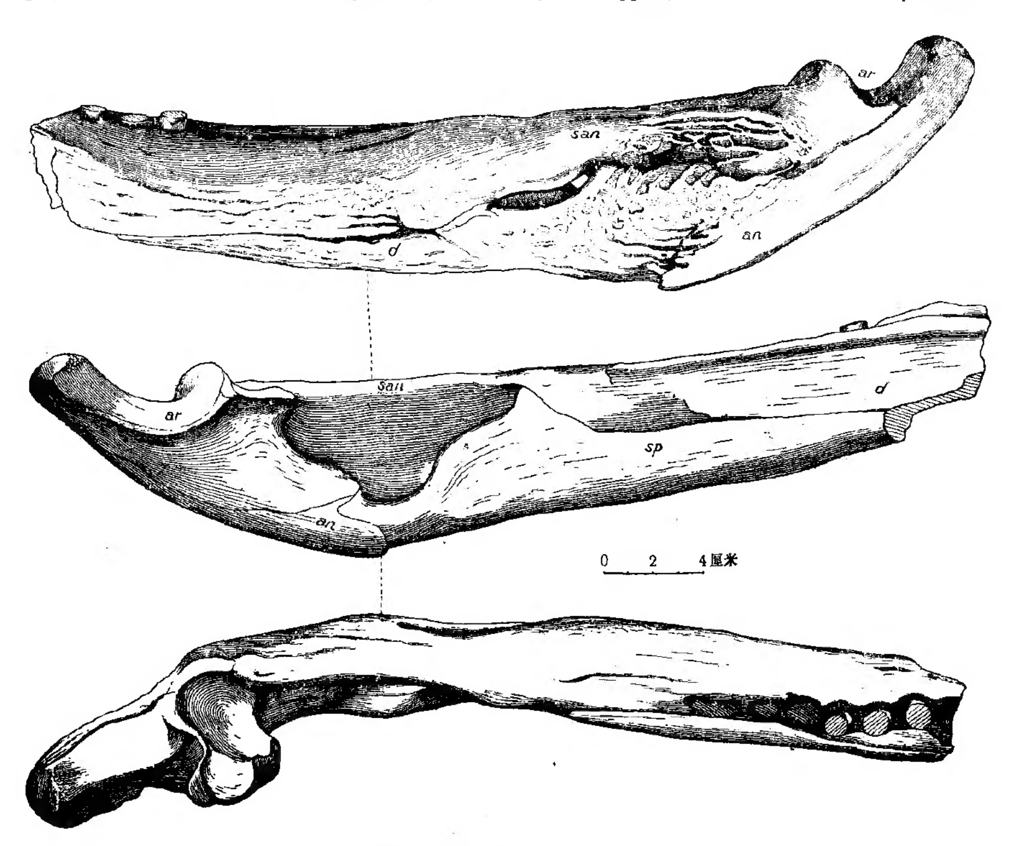


图 2　南岭亚洲鳄(新种)，右下颚外视，内视及上视　1/3 原大。
Fig. 2. ***Asiatosuchus nanlingensis*** **sp. nov. Right lower jaw in outer, inner and upper views. 1/3 nat. size. an, angular; ar, articular; d, dentalry; san, surangular. sp, splenial.**

骼的表面，雕紋粗而稀。破牙齿的横断面近于圓形，彼此很靠近。下顎底部在牙骨孔以前相当平。总的說来，和蒙古的种很相近。

几个脊椎骨具有鰐类的特性为前凸式。其他骨骼均很破碎。可辨认的有喙头骨的近端和一股骨的远端，看不出和近代鰐类有何显著的区别。

附加标本：除了另外一个下顎骨的縫合綫部，为另一个体外，所有 6227 地点的骨骼，显然归于同一个体。所指的 6227 的右下顎代表从后部縫合綫处一直到牙骨孔前的部分，因之很可以补充正型标本的不足。这一下顎的大小和骨面雕紋与正型标本完全相同，无疑与之同归一种。下顎內側由夹骨所形成的沟很深，向前几乎伸至縫合綫部的后緣，但未完全达到，这一点与谷氏亚洲鰐相同。不幸的是下顎的縫合綫部未完全保存。但其后部向內側伸延之状尙可辨认，相当之厚。共有 14 个牙槽，包括两个完整的牙和两个破了的牙。由谷氏亚洲鰐和下边要描述的另一对下顎縫合处来判断，似乎还缺少 6 个或更可能 5 个牙齿。因此牙齿的总数大約为 19—20。保存的两牙为由后端算起的第四和第六个牙。牙冠較低，具有不大規則的放射条紋和清楚的前后脊稜，这都和谷氏亚洲鰐相同。另外从同一地点还有 5 个单个牙，其构造也和上述的相同。

其他骨骼均較殘破，不堪記述。

5 个脊椎骨和正型的相同。另外有一破骨可能代表肩胛骨的近端。

現在再回到那一对下顎的縫合部分(第 3 图，下图)。这一标本的性质，肯定和上述的

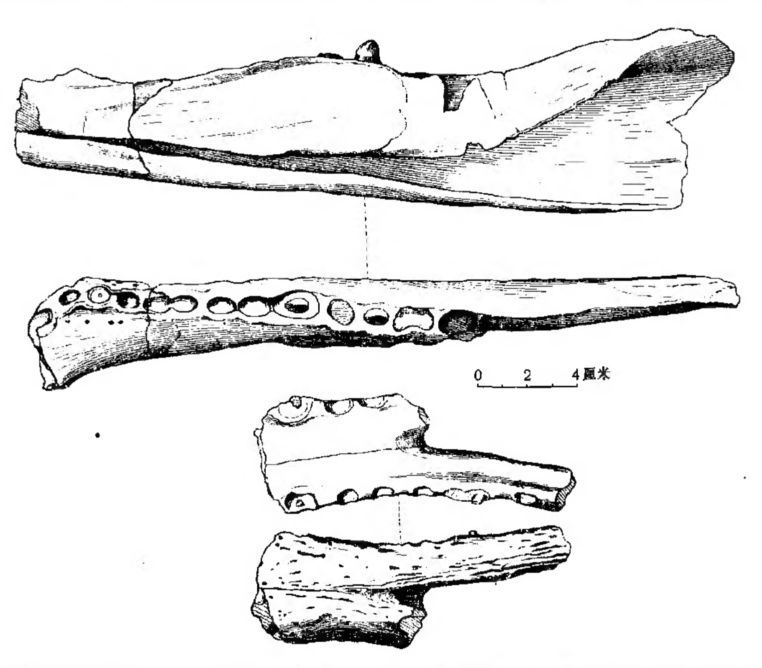


图 3　南岭亚洲鰐(新种)　上图，右下顎內視及上視　下图，另一下顎的縫合綫部分　均 1/3 原大。

Fig. 3. *Asiatosuchus nanlingensis* sp. nov. The upper figure. Right lower jaw in inner and upper views. The lower figure: symphysal part of a pair of lower jaw in dorsal and ventral views. All from locality 6227 and 1/3 nat. size.

不太相同。縫合处看来長而纖細，其前緣已破，两个下顎在縫合处紧密連合一起，保存之長約为 68 毫米。縫合处相当之平，有兴趣的是前部比后部宽一些，这由于后部稍为收縮

所致。左边有10个牙槽，右边有6个牙槽保存。由前边破裂处判断，很可能每一下顎的犬齿状大牙前只有2个牙。在这一大牙后其他牙孔大小差不多相同，彼此較为分开。縫合处后部位于大約第六个下顎牙的相当部分。在左下顎的后端只有一个眞正的牙保存，其一般性质和上述者相同。

这一付破下顎比上述的几个下顎稍小一些，但似乎还是在变异的大小范围以內。主要的特性是縫合綫处之长和后部之收縮，前端只有2个牙以及牙的間隔相当之大。除此以外，其他性質均和正型和副型标本相同。也有可能，这一对下顎代表另外一种鰐类，但更为可能的是当作上一种的一較年纺的个体。

另外两地点的材料，都十分破碎，V. 6217 的为一下顎的关节部分。而 V. 2721a 只为破碎下顎的中部，在大小和骨面雕紋上和前述的标本相同。

重要尺度見外文部分。(頁 201)

討論:

虽然材料不太多，且不完全，但由已有部分足可得出結論，即南雄的鰐和亚洲鰐很相近。下顎的大小和形状以及牙齿的构造彼此均十分相象。虽然沒有一个完整的下顎标本，但是由已有的下顎相互比較，可以看出，下顎的牙齿部分比牙列的后部为短。这也是亚洲鰐的一个重要特性。另一方面，也有些区别，南雄的标本显然更碩大一些。牙数也多一些。如果那一对具有縫合綫的下顎也归于这一种的話，南雄的化石和內蒙古化石的区别，还要大一些。虽然南雄标本的縫合处后部位于第六个牙齿的位置(同蒙古的一样)，但我們的只有2个犬牙状牙前的牙而不是3个。此外，如上所指出，縫合处两側的形状和蒙古的标本很不相同。

由此看来，我們認为应当把南雄标本，当作另一新种，取名为南岭亚洲鰐(新种)，其特性有如上述。

谷氏亚洲鰐来自內蒙古二連西南的晚始新世时代的地层中。我們的标本，应当属于古新世(根据哺乳动物化石判定的)。亚洲鰐这一属也能見于古新世，并不是什么奇怪的。

在湖南发現的两种鰐类(衡阳两湖鰐和湘江田氏鰐)都很破碎不易和本种相比較，这两种的年代被当作中或晚始新世的产物。

猛鰐亚科(Alligatorinae)

始猛鰐(新属) *Eoalligator*

特性: 見代表种存义始猛鰐

存义始猛鰐(新种) *Eoalligator chunyii* sp. nov.

正型标本: 一头骨后部，一对下顎和若干不能詳为鉴定的骨骼，非常可能属于一个个体。野外号 6218。本所化石編号为 V. 2716。

附加标本: 一右下顎前部，一左下顎后部，一頸脊椎和若干破碎骨骼。野外号 6219。本所化石編号为 V. 2721。这是唯一地点与上述南岭亚洲鰐和鈍脚类同地发現，一破碎下顎，野外号 6214。本所化石編号为 V. 2771。

层位与地点: ?古新統。南雄城西南 210 号公路标 416 附近。南雄西南修仁东約1公里。南雄西南的风門坳附近。

特性：中等大小。头上平台微显凹陷。两上颞颥孔間的收縮很窄，具有明显的沟。在下顎骨中間大牙齿旁有由夹骨造成的显著的高稜。夹骨似伸入到两顎的縫合处。牙齿至少有 20 个，比中国猛鳄为多。在前部犬状牙和中部大牙之間，只有 6 个較小的牙。中部大牙后至少有 5 个牙保存，可能有 10 个左右。

描述：头骨只后部保存。后边附着几个頸脊椎骨和肋骨位置錯乱。同近代鳄、猛鳄等比較起来，几无何显著区别。只有头上平台稍呈向斜状，两孔間距离很窄，且有一深沟。骨的表面飾紋很粗大，头后很凹入，主要由于头上平台向后伸起之故。关节髁很粗大。

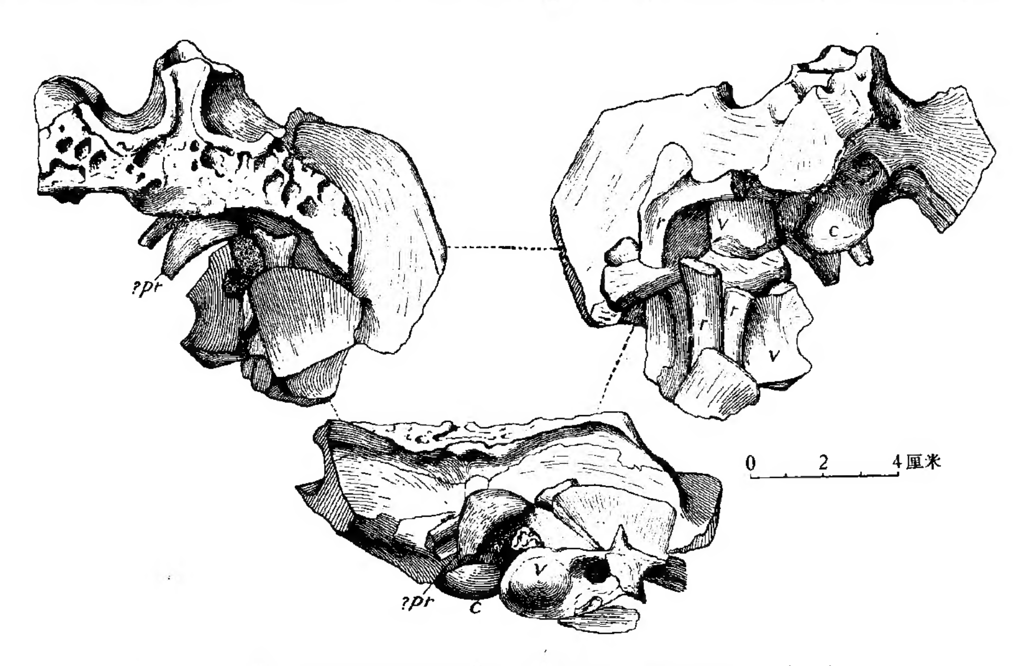


图 4　存义始鳄(新属新种)头骨后部背視，腹視及后視　1/2 原大。

Fig. 4. *Eoalligator chunyii* gen. et sp. nov. Posterior part of a skull in dorsal, ventral and posterior views with part of the anterior neck vertebrae and ribs. 1/2 nat. size. c, condyl; pr, probably proatlas; r, rib; v, vertebra.

其他头部骨骼，大部破碎。一左上顎前部和一左上顎后部，可能属于同一个体。前者主要为前上顎部，但最前部已破。犬齿状大牙保存，很尖銳，具有放射状稜。在这个牙以前，为另一保存較差的牙，代表前上顎骨的第三牙。最前面牙未保存。在这犬齿状牙以后，至少有 5 个牙孔，其中有 3 个彼此相通。象在猛鳄常見的位于牙列內側介于犬齿状齿后。第一与第二牙之間有一凹陷，此为下牙所穿成，虽然小而很深。

另外一标本，可能代表眼孔前不远处。側面有一显著的平台，为近代猛鳄所无，在腹側有 5 个牙孔，包括两个新的代替的牙。这两牙为低冠，前后有稜，和近代猛鳄不很一样。前端近破裂处的第一破牙可能为上顎中間最大的牙。

右下顎保存較好，但两端均破裂。左下顎只有近縫合处一小部分保存。如前所述，下顎的內側有一向上突起的稜，此由內側的夹骨造成。虽然不很显著，但看来夹骨似向前通到縫合綫处，即在外側下顎中部的向上突起，也比所有我可以用之比較的近代鳄类骨骼为高。在这一点上，我們的标本，可以和北美的 *Allognathosuchus polyodon* 相比較。縫合綫

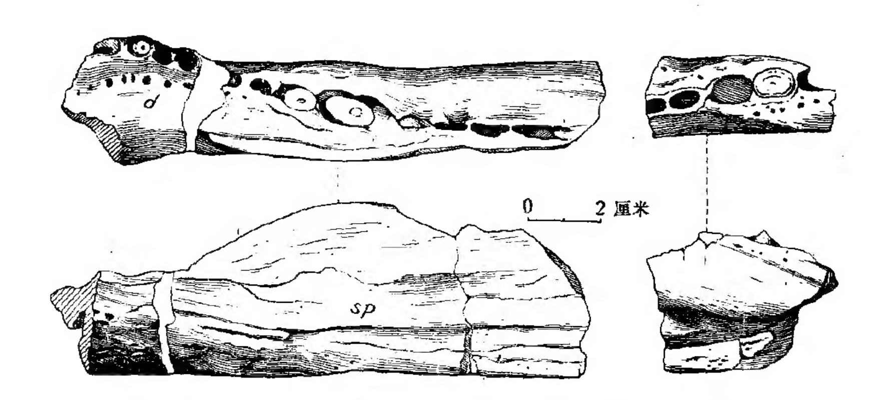


图5 存义始鳄(新属新种)右下顎,上視及内視 1/2原大。

Fig. 5. *Eoalligator chunyii* gen. et sp. nov. Right lower jaw in upper and inner views. Abbreciations as before. The fragment showing in the right part of the figure in two views may pertaining to the main part of the jaw. 1/2 nat. size.

处的前端未保存,但就后部来判断,相当之厚而粗壮。其向內側伸延处只局部保存,但左側的保存較好。骨头表皮的飾紋比近代种为粗。很可能另一具2个小的和3个大的牙孔的右下顎殘片,卽为上述右下顎的后部,可惜无直接接連,难以判定。

下顎的牙齿数目难以判定。如果那一殘片右下顎和那比較完整的右下顎眞为一个体的話,那末下顎牙齿的数目,至少为23个。因两标本已有大約20个牙孔(18个眞牙孔,至少2个标本間假定的牙孔)。而犬齿状牙前至少应当还有3个牙。如果不是这样,那末牙的数目应当約为17个。牙齿可以清楚的按大小区分为不同的組。两大牙之間,只有6个牙孔,上述的北美种为8个,近代猛鳄也为8个。中間大牙位于向上突起的最高处,特大,其前的牙也相当之大,此牙后的5个牙孔小而左右多少挤压。前边的牙卽由牙孔也可清楚地看出向上向外情况,如果那一殘破下顎眞属于較完整的那一标本的話,牙列后几个牙,也特別大,这看来是不大可能的。

头后骨骼,都很破碎。有若干甲片和一个糞化石。前者沒有什么特別之点,后者当与其他糞化石一起討論。

若干重要尺度可看外文部分。(頁203)

其他归入于这一新种的标本,均很破碎,6219那一地点的下顎較小,可能为一年幼个体。

討論:

尽管材料很不丰富,但現有标本应当代表猛鳄亚科的一个新猛鳄。所有可以鉴定的标本,都和这一亚科的特性相近,甚至和中国揚子鳄也相近似。

但如上所述,这些标本,也指出了一些特性,如中部上突起之稜,是非常特別的。牙齿的数目虽不能肯定,但牙齿大小的特別分化,表現在犬齿状牙和中間牙的相当大,是十分清楚的。两大牙中間的牙为六个,也和其他种不同。上顎后部的牙也比較大、窄和有前后稜。根据这些特点,我們认为应当为一新属新种,名叫存义始猛鳄,其特征已列举于上。这种名是贈給王存义同志的,他在1962—1963年,在南雄工作中,起了很大作用。

至少就所保存的部分来判断,这个新种和上述的那北美种有些相似之处,主要在下顎

的形状以及前部牙齿的位置和斜向方面。

因为大多数鰐类化石在古新世和始新世都为同一种，甚至晚白堊世也如此，所以目前的化石对鉴定年代講，不能作出肯定的結論。就目前根据哺乳动物所訂的古新世的說法，从鰐类方面来看，提不出任何相反的意見。相反的在 6219 地点，不但有上述的南岭亚洲鰐，还有古新世的鈍脚类化石。

在南岭以北所发現的两种鰐类（两湖鰐和田氏鰐），由于材料彼此都不全，很难比較。尽管如此，田氏鰐的单一的牙，和我們的新种的牙有些相象，在目前，未有更多的材料以前，很难講这些相似之处表明什么意义。

馬来鰐亚科 Tomistominae Kaelin

始馬来鰐（新属）*Eotomiostoma* gen. nov.

特性：由以下所描述的多齿始馬来鰐代表。

多齿始馬来鰐（新种）*Eotomistoma multidentata* sp. nov.

材料：一头骨右側的眼前部分。本所化石編号为 V. 2774，野外号 60-1-F. 1581。为內蒙古地質局的野外队所采，承該局将标本交来鉴定并惠贈給本所，十分感謝。

层位与地点：所含化石地层，野外队定为下白堊統上部。就化石性質言，可能稍高一些，卽上白堊統下部。地点为內蒙古伊克昭盟鄂克托旗西約 80 公里。

特性：为长吻形，且較纤細。前部收縮非常輕微。牙齿很多，估計在 48—51，比一般的鰐类均多，口腔上部近眼下孔部的外翼骨有纤小牙齿，上顎骨中部內側也有此等牙齿。下眼孔比眼孔更靠前一些，牙齿尖銳，有稜。

描述：在图 6 所表示的这个标本代表眼孔前的右側。可惜靠中綫部，多少不完全，因之看不出鼻骨和上顎的接触关系，其他骨的接合縫也不明显。在收縮部后部前顎骨和上顎骨間，有一小部分缺失而加以复造，因之是假設性的。在腹視，一部分眼下孔的外边緣可以看見。外翼骨和上顎骨的縫合綫可以辨出。骨为淡黃色，骨面的飾紋較細。就化石的情形看，不象是湖泊沉积，牙孔中所含的东西为深灰色的沙子。

就保存的部分判断，这个鰐的头前部长而細。在犬齿状牙旁，并无显著的缺口，而代以很微小的收縮。眼孔只有前部边緣局部可辨，所以不能知道眼孔的全形。但是可以判定并沒有象現代种所具有的向前伸出的深弯。此外，这个标本具有很多的牙孔。在用石膏复造的前部就有 13 个牙孔和牙。后部則有 25 个。估計最前部至少还应有 1 个牙齿，而两者之間可能还有 3 个到 4 个牙。此外，又考虑到一般鰐类的牙列向后延伸到眼孔旁的中部，那么这标本后部可能还有 7 个到 8 个牙齿缺乏。这样計算起来，全部牙齿的数目可能为 14＋3—4＋25＋7—8＝49—51。就是考虑一半的牙孔，为代替的牙所造成，一半为实际使用的牙，其数目在 25 上下也是很多的。除在 *Tomistoma schlegeli* 約为 30 外，就所掌握的材料来看，沒有一种鰐有这样多的牙齿。

大多数的牙，仅留牙孔。只有 6 个或多或少保存的牙齿。犬齿状牙前有 5 个牙。这一部分唯一保存的牙尖銳而具有稜。由牙孔大小判断，这些牙愈向后愈大。犬齿状牙比前一个几大一倍。在这犬齿状牙后，有 8 个牙孔，其中第五个牙本身保存。这个牙很小。所有这些牙或牙孔圓而彼此靠近。上顎主要部分共 25 个牙孔和齿（有 5 个牙），这些牙也

此靠近，但为骨质物所隔，而相当显著的左右伸长，和前部者不同。靠前的5、6个牙比小，后部者較大。靠后几个又小一些。

另一有兴趣的特性就是下眼孔后部外翼骨上有两排小牙，有3牙保存完好，其他均只小孔。在上顎骨中部內側，也有这种牙存在的痕迹。在一般的現代鱷或化石鱷，都未見此等情况。只有广东茂名由叶祥奎所描述的鱷（*Tomistoma petrolica*）的內模腹側前部此等現象。可能这个种头后部也有此等牙。

关于尺度見外文部分。（頁205）

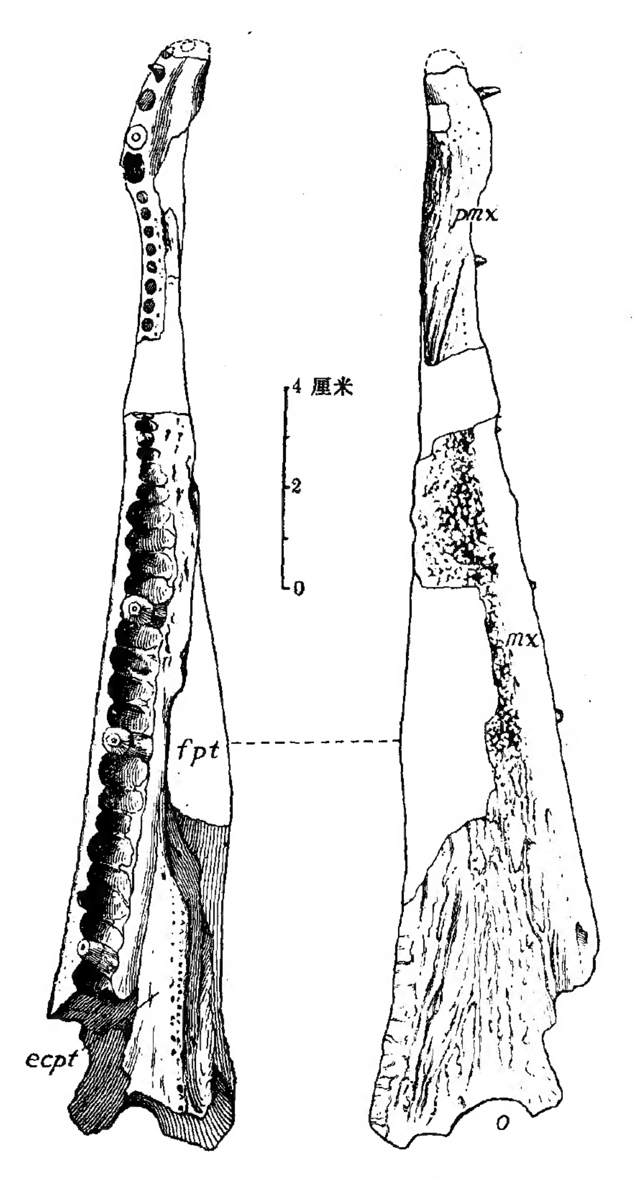


图6 多齿始馬来鱷(新属新种)头骨碎片，上視及腹視 2/3 原大。

Fig. 6. *Eotomistoma multidentata* gen. et sp. nov. Skull fragment in dorsal and ventral views. ecpt, ectopterygoid; fpt, foramen pterygoideum; mx, maxilla; o, anterior part of the right orbital opening; pmx, premaxilla. 2/3 nat. size.

鉴定与討論：

虽然內蒙古的标本保存不太好，但是有几点特性，表明和馬来鰐亚科有些关系。特别是眼孔的部分和此科的属很象。不幸的是，我們不能肯定鼻骨的形状。蒙古标本，也另外有两个性质特为显著。一个是牙齿的数目，另一个是口腔上部的小牙。在我国茂名的标本中，前部亦有小牙的存在。我們的标本，前后都有。

按照野外标签，这个标本应为下白堊統上部 $Cr._1^4$。但最早的这一亚科的化石为上白堊統。具有两种可能性，一个是我們的标本，代表这一科最老的化石，可以是下白堊統。一个是那地层稍晚一些，为上白堊統底部或更高。从这样不完全的标本，使我們很难得出肯定的結論。

无論如何，这个标本代表这一亚科的一新种是无疑的，故定名为多齿始馬来鰐（新属、新种）。属名表示其年代很老，种名表示其牙齿的特性。特征已見上述。

这个标本代表在中国发現的这一亚科的第二个标本，而年代較老。

广东南雄的鰐魚粪化石

除了只有一个粪化石产自 6218 地点以外，其他 22 个粪化石均产自 6227 地点，和南岭亚洲鰐相同。前一类化石属于存义始猛鰐。在两个地点，沒有发現过其他脊椎动物。所以我們有理由相信，这些粪化石的“制造者”就是与之同存的有关鰐类。

各粪化石的大小不同，长度由 45 毫米到 115 毫米。一般微显扁平而弯曲。有較尖的一端。其中一部分見图版 I 和 II。大多数标本的表面，是比較光滑的。但有时也有些异体印痕可以看出。排泄时由于收縮所造成的压挤痕在一些标本很清楚，不能和上述印痕相混（图版 I, D）。一些气孔，特别在破裂面，相当清楚，但总的說来并不很多。多数的粪化石都主要为排泄物所造成，所含异体很少，只有图版 II, C 这一标本，含有一些小石砾。这个标本，也比較扁平。由于风化程度关系，有些标本，很坚实而硬，有的比較松散而輕。在几个标本上（图版 II, C），在另一面还有小骨本身或者其他印痕可以看到。

感謝本院地質研究所化驗室，把 6227 的粪化石加以分析，知道所含五氧化二磷相当之多，約为百分之 11.35。

把我們的粪化石和北京动物园所飼养的中国揚子鰐所排的粪相比，很有些相似之处，但也有所不同（图版 I, A）。动物园飼养的鰐的粪，可能为一年幼个体所排泄的，而也可能受了人工飼养的关系。但仍然显示出同样微微扁平状和同样的微弱弯曲。只是这个标本多了一些直的印道，也比較小一些。

最近詹普生（1963）描述了一些北美达冠塔的金谷系所产的一些粪化石。就其描述和附图来判断，在一般性质上和大小上和我們的标本不无相似之处。只是北美标本，附带的有机体物质更多一些。北美标本为始新世，比我們的晚一些。按照詹普生的說法，北美的粪化石是由肉食性的爬行动物造成的。同一作者在同一文章中指出，金谷系动物中一共有 4 种不同的鰐类，和其他动物来比，最有資格成为这些粪化石的“制作者”。如上所述，并无其他动物与我們的化石共生，因此我們可以肯定，这些鰐就是这些粪化石的“制作者”。两地点均如此。自然两地点的鰐，种类不同。但是我們可以肯定的說，根据粪化石的性质，是不能区别种类的。

在南雄发現鰐类的粪化石是十分有趣而重要的。在我国,这是发現爬行动物粪的第一次記录。最近曾描述了一些地质年代很晚的哺乳动物粪化石(高福清,1962),这些粪化石和我們的粪化石相比,很不相同。

中国鰐类化石研究的回顧

自从1948年記述了中国发現的鰐类化石以后,十多年来,不同的作者在不同的地点、不同的层位研究了不同的鰐类,使我們对于这一門类的知識大有增加。再加上本文所記述的新的种类,使我們有可能对中国的鰐类有較清楚的了解。到目前为止,中国鰐类的地层分布与产地可看外文部分的有关附表。(頁207)

本表中有3种鰐类(附以星号(*)者),是在蒙古人民共和国南部,和我国边界很近处发現的,这是到目前为止所知道的白堊紀鰐类化石分布的最北界,所以附入,以帮助了解。

由这个表可以看出,近年鰐魚的种类,大大地增加了。但是不容否認,这些門类的多数材料不全,有些只是由很破碎而少的标本为代表,所以到底有沒有研究价值是很值得怀疑的。另外想指出的就是所增加的 *Teleosaurus* sp. 可能和长鼻北碚鰐为同物异名。因为两者很相近,且在同一地层中找出。

値得特别一提的就是,自始新世后一直到第四紀,在各时代丰富的动物羣中,从未見过有鰐类化石的报导。可是在欧洲上新統,还有鰐类化石发現(許耐,1963)。相反的侏罗紀、白堊紀、古新世及始新世鰐类分布的广闊是值得注意的。如我們所知,鰐类是一个很好的表明气候湿潤和温暖的动物。

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NEW FOSSIL CROCODILES FROM CHINA

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Since the publication of my paper on fossil crocodiles in 1948, our knowledge concerning this group is considerably increased and many new forms have been described by Young and Chow (1953), Bohlin, (1953), Sun (1958), Yeh (1958), Young (1961) and Liu (1961). Recently, some tolerably well preserved crocodiles with rich remains of coprolites have been discovered from Nanhsiung in N. Kwangtung. This is particularly interesting because it is most probably of paleocene in age, according to the mammalian remains found from the same horizon. In addition a fragment of skull was found by the Bureau of Geology of Inner Mongolia from Otok S. W. of this territory, of lower Cretaceous, according to field observation. They are described in the present notes.

DESCRIPTION OF NEW FORMS

Family Crocodilidae Kaelin 1955, non Cuvier 1807

Sub-family Crocodilinae Kaelin 1955

Genus *Asiatosuchus* Mook 1940

Asiatosuchus nanlingensis sp. nov.

Material:

Type: Rather well preserved pair of the posterior part of lower jaw, and a few vertebrae and fragments of limb bones from ca. two kilometers N. W. of Hukou, Nanhsiung, N. Kwangtung. Field number 6228, Cat. number V.2773.

Referred specimens: The symphysal part of a pair of lower jaw, right incomplete lower jaw. Some jaw fragments, a few vertebrae and fragments of limb bones. From ca. one kilometer west of Hukou, Nanhsiung, Kwangtung. Field number 6227. Cat. number V.2772. Articular part of a right lower jaw from a place ca. 4 kilometers S. W. of the Nanhsiung city. Field number 6217. Cat. number V.2775. A lower jaw fragment from one kilometer E. of Siuzen Nanhsiung. Field number 6219 cat. number V.2721a.

Horizon and locality: ?Paleocene. Localities as noted above.

Specific characters: Similar to *Asiatosuchus grangeri* but more robust and larger. Dental teeth 19—20, may little more in number than that of the named form. Anterior part of the lower jaw more constricted posteriorly. Dental foramen small.

Description: All the above listed specimens are very fragmentary. The better preserved ones are the lower jaws from localities 6228 and 6227. All the vertebrae and the lower jaws as well as the other determinable bones are agreeable in structure and size so that it is certain to regard them as pertaining to the same species. Even the colour of the bones is the same which is pale grey. The matrix is a typical kind of pulplish sandy clay.

The Type. The lower pair of 6228 are only represented by the posterior part and

found in isolated condition. But they are certainly of the same individual. A fragment of a right one may belong to the right lower jaw but without direct connection. The left one with the anterior part better preserved with seven alveoli including three broken teeth. (Figs. 1—2, p. 190.)

The size of both jaws is closely comparable with that of *Asiatosuchus grangeri* Mook but somewhat larger. The dental foramen is very narrow and comparatively small. The surface of the bone is only coarsely sculptured. The preserved broken teeth show rounded cross section and are rather closely situated. The ventral part of the jaw in front of the dental foramen is flat. On the whole the lower jaws are very similar to those of named species.

The few vertebrae are all procoelous and typically of crocodilian nature. The other bones are also too fragmentary for a detailed description. The proximal part of a coracoid and a distal part of a femur are all similar to those of the recent crocodiles.

The referred specimens. Most of the remains of locality 6227 represent one individual except the another specimen with the part of symphysis because the right lower jaw shows the posterior part of the symphysis (V.2772a). The named right lower jaw represents the middle part from the posterior part of the symphysis up to the part in front of the dental foramen and thus supplement much the type lower jaws. It is about the same size and also with the similar sculpture. It belongs undoubtedly to the same species. At the inner side the furrow for the splenial is deep and extends almost anteriorly to the very posterior border of the symphysis. Unfortunately the part of symphysis is missing but the medial extension of the posterior end of it is clearly recognizable. (Fig. 3, p. 191) It is fairly thick. There are 14 teeth sockets preserved with two fresh teeth and two broken ones. Judged by the dentition of *Asiatosuchus grangeri* and the jaw pair described below, there are probably six or more likely five teeth missing, so that the total number of teeth of our form is probably 19 or 20. The two fresh teeth are the fourth and sixth counting from behind. They are low crowned with irregular rugose striations and distinct sagital ridge as in the case of the Mongolian form. The five isolated teeth from the same locality duplicate the same features of the described ones.

The other bones are too fragmentary for a detailed description.

There are five isolated vertebrae with the same size and structure of these of the type. There is a broken bone which may represent the proximal part of a scapula.

Now turn back to the specimen with the part of symphysis (Fig. 3, lower figure). It is certainly quite different from the specimens described above. It is long and slender. Its anterior border is damaged. Both jaws are firmly co-ossified and with preserved length about 68 mm. The part of the symphysis is fairly flat. The anterior part is somewhat broader due to the weak constriction at the posterior part of the symphysis. There are ten tooth sockets at the left side and six at the right side. It is most probably that there are only two teeth in front of the first canine-like large tooth of each jaw, as judged by the breakage of the anterior end of the specimen. Following this tooth all the other teeth are sub-equal in size and rather widely spaced. The symphysis extends back to the level of the sixth mandibular tooth. There is only one actual broken tooth at the posterior part of the left lower jaw which shows also the typical anterior and posterior median ridge and the striations on the crown surface.

The size of the specimen is a little smaller than the other lower jaws described above but still well in the limit of individual variation. The main differences, however, are the

relatively long and weak constriction of the symphysis, only two anterior teeth and the well spaced nature of the other teeth. Otherwise all the other features agree well with the type and the other referred specimens. It is possible that we have to deal with another type of crocodile but more likely with a rather young individual.

The remains from other localities are too poor for a detailed description. The right lower jaw from V.6217 is represented by the articular part and the other fragment from V.2721a is only indicated by the middle lower part of the left jaw. Both are the same size and same sculpture as the other specimens.

Important measurements (in milimeters)

Total length of the lower jaw estimated from the described specimens	550
Preserved length of the left lower jaw of V.2773	375
Height of the same before the dental foramen	56
Breadth of the same before the dental foramen	38
Length and breadth of the glenoid surface	33 and 59
Length and breadth of the dental foramen	43 and 9
Preserved length of the right lower jaw V.2772	290
Length of preserved part of the symphysis of V.2772a	68
Anterior breadth of the same	45
Minimum breadth near the posterior end of the symphysis of the same	40

Discussions:

Although the materials at disposal are rather scanty but it is sufficient to get the conclusion that we have deal with the genus *Asiatosuchus* known from Inner Mongolia. The size and the general shape of the lower jaw as well as the character of the teeth and so on are very close each other. Although there is no complete dentition preserved, it is probable that the dental row is shorter then the postdental portion of the jaw as estimated by the preserved lower jaws. This is also an important character of this genus. It is, however, more robust and larger than *Asiatosuchus grangeri*. If the attribution of the part of symphysis is correctly determined, the difference between the Kwangtung form and that of Inner Mongolia is still more obvious. Although the symphysis extends back also to the level of the sixth mandibular teeth as in the case of the Mongolian form but we have only two instead of three teeth in front of the large canine like teeth. As mentioned above, the general shape of the part at both sides of the symphysis is quite different from the Mongolian species.

In view of such differences we prefer to consider the present form as a new species for which the name *Asiatosuchus nanlingensis* is proposed.

Asiatosuchus grangeri is derived from Irdin manha formation and considered to be Upper Eocene in age. The present form is supposed to be Paleoncene in age according to the preliminary determination of the mammalian fossils found from the same place. It is not at all surprised that this genus occurs also in the Paleocene time.

The two genera of crocodiles from Hunan, *Lianghusuchus hengyannensis* and *Tienosuchus hsiangi* are too fragmentary for a close comparison. They are all Middle or Upper Eocene in age.

Sub-family Alligatorinae Kaelin 1955

Eoalligator gen. nov.

With the diagnosis of the type specie *Eoalligator chunyii*, sp. nov.

Eoalligator chanyii sp. nov.

Type: A broken skull with the part of the cranial table better preserved, broken lower jaw pair and some undeterminable bones apparently belonging to the same individual. Field number 6218, Cat. number V.2716.

Referred specimens: A fragment of an anterior part of a right lower jaw, posterior part of a left lower jaw, a neck vertebra and some undeterminable bones. Field number 6219. Cat. number V.2721. In this locality, remains of *Asiatosuchus nanlingensis* and Pantodonta have been found. A poorly preserved lower jaw with some isolated teeth. Field number 6214. Cat. number V.2771.

Horizon and locality: ?Paleocene from 210 high way, 416 bench mark S. W. of Nanhsiung (Type); One Km. E. of Hsiujen S. W. Nanhsiung and Fenmenao S. W. of Nanhsiung city (the referred specimens).

Diagnosis: Alligatorinae of moderate size. Cranial table weakly depressed. Constriction between intersupratemporal openings narrow. Lower jaw with prominent vertical ridge formed by the spenial at the inner side of the largest middle teeth. Splenial extends apparently anteriorly to the symphysis. Lower dentition at least 20 in number, more than *Alligator sinensis*. Only six teeth between the first canine like tooth and the largerst one at the middle of the jaw. At least five teeth preserved posterior to this latter tooth.

Description: Skull. Only the part behind the supratemporal openings with the occipital plane and the condyle is preserved. The anterior vertebrae including the ?proatlas and probably first two vertebrae and some ribs are sticking still to occipital plane, of course much displaced. So far we can compare with the recent *Crocodilus* and *Alligator*, there is no distinct difference except that the cranial table is weakly depressed, forming a faint synclinal appearance. The constriction between the supratemporal openings is narrow and the furrow is deep. The surface is coarsely sculptured. The occipital plane is deep due to the strong overhanging of the cranial table. The condyle is robust. (Fig. 4, p. 193)

The other part of the skull is too fragmentary for a detailed description except the anterior part of a left upper jaw and the posterior part of a left upper jaw, apparently the same individual. The former is formed chiefly by the premaxilla but the anterior end is broken. The canine-like tooth is well preserved which is sharply pointed with stritions. In front of it, there is a less well preserved one which represents the third tooth of the premaxilla. The two other teeth in front of it are lost. Posterior to the canine like tooth there are at least five alveoli, the last three of which are confluent each other. The fossa, as usually found in the Alligators, at the inner side of tooth row lies at the level between the first and the second tooth posterior to the canine-like tooth. It is small but rather deep.

The second specimen represents probably the part immediately before the orbit. There is a distinct shelf developed at the lateral part of the bone. This is not observed in the recent alligators. In ventral view there are five alveoli with two fresh substitute teeth well preserved. They are low crowned with distinct sagital ridge quite different from the recent alligators. The first broken tooth near the anterior breakage is probably the largest tooth in the middle part of the upper jaw.

The right lower jaw is better preserved, although the both end are broken. The left one is only represented by part near the symphysis. As chiefly indicated by the

right lower jaw, the mandible is characterized by the unusual prominent upward undulation, especially along the inner side. It is due to the upwards ridged development of the spenial. Although badly preserved, it seems probable that the splenial extends anteriorly to the part of the symphysis. Along the outer side, the upward extension of this part is also much stronger than both the genera *Alligator* and *Crocodilus,* I have for comparison. In this respect our form is much like that of *Allognathosuchus polyodon* from N. America. The anterior part of the symphysis is broken but the posterior part shows that it is thick and robust. The medial extension is only partly shown, but better preserved in the left one. The surface of the bone is more strongly sculptured than that of the recent forms. It is probable that the other jaw fragment with two small and three large alveoli may be the posterior part of the right one, but no direct contact surface. (Fig. 5)

The number of the teeth of the lower jaw is not known. If the named fragment belongs really to the right lower jaw the number of the teeth is at least twenty three because we have already about twenty alveoli in the two specimens (eighteen actual ones and two hypothetical ones between both specimens) and there are certainly three anterior teeth in front of the large alveole. In the other alteration the number of the teeth has to be estimated as about seventeen. The teeth are definitely arranged in groups. There are about six smaller teeth between the two largest teeth. In *Allognathosuchus polyodon* it is separated by eight small teeth. (The same is for the recent *Alligator sinensis.*) The middle large tooth is situated at the summit of the upward elevation and is especially strong, much larger than the first large tooth. The tooth in front is also comparatively large. Posterior to this large middle tooth there are five smaller compressed alveoli. All the teeth of the anterior part of the lower jaw direct distinctly obliquely outward as well as upward. If the doubtful lower jaw fragments belong to the right one, the posterior teeth are again much larger in shape which seems rather improbable.

The post cranial skeletons are too poorly represented and very fragmentary. Rather interesting is the presence of a few dermal scutes and a complete coprolite. The former do not shown any special feature and the latter will be studied together with the other coprolites from 6227.

Important measurements (in milimeters)

Breadth between the supratemporal openings	11
Posterior breadth of the cranial table	92
Height of the right lower jaw at the summit of the upwards elevation	45
The same behind the symphysis	13
The same near the posterior breakage	38
Length and breadth of the middle largest broken tooth	12 × 8

All the referred specimens are very poorly preserved. The size of the jaw of 6219 is somewhat smaller. They are probably of a young individual.

Discussion:

Although the material of the present form is very fragmentary it seems quite certain that we have to deal with a new member of the sub-family Alligatorinae. All the determinable bones show the close affinities of this sub-family, even with the recent species *Alligator sinensis.*

But as noted above, the present form is characterized by a number of special fea-

tures, especially the construction of the lower jaw. The prominent upward elevation of the middle part of the lower jaw is very characteristic. The teeth are much more differentiated, due to the strong development of the anterior canine like tooth and the other one at the summit of the named elevation. The number of the teeth between the first large tooth the other one in the middle of the jaw are only six instead of eight of *Alligator sinensis* and eight in *Allognathosuchus polyodon.* The posterior teeth of the upper jaw are comparatively large and compressed with distinct ridge. Based on all these facts it is certainly that we have to deal with a new form of Alligatorine for which the name *Eoalligator chunyii* gen. et sp. nov. is proposed. Its diagnosis is already cited above. The specific name is dedicated to Mr. Chun-yi Wang, who has worked in Nanhsiung and is responsible for great part for the successful work in that region in 1962—1963.

So far as the preserved part allowed to judge our new form may bear some resemblance with *Allognathosuchus polyodon* in the shape of the jaw and the oblique direction of the anterior teeth.

Concerning the age of the fossil at disposal there is no clue for a definite conclusion, since most of the crocodiles are both found in Paleocene and Eocene, and they even may be older or latter. For present we failed to find any objection for considering the age of those fossils as Paleocene as indicated by the remains of mammals. On the contrary, in the locality 6219, crocodiles are found together with remains of *Asiatosuchus nanlingensis* and Pantodonta the latter of which suggest a Paleocene age of the formation.

The two genera, *Lianghusuchus* and *Tienosuchus* found just north of the Nanling Range are hardly comparable with the present form. It must be remembered, however, that the single tooth of *Tienosuchus* shows some similarities with that of our form. It is hard to say any definite meaning of this resemblance.

Sub-family Tomistominae Kaelin

Eotomiostoma gen. nov.

With the diagnosis of the type species *Eotomistoma multidentata.*

Eotomistoma multidentata. sp. nov.

Material: A broken skull represented by the right part immediately before the orbital opening. V.2774. Field number, 60-I-F 1581. Collected by Field part of the Bureau of Geology, Inner Mongolia.

Horizon and locality: Lower part of Upper Cretaceous from Otok district (Ca 80 km west of the head office), Ikechaomeng, Inner Mongolia.

Diagnosis: Snout slender. Constriction of the anterior part of the snout very weak. Teeth number at least—48, much more than most of the crocodiles in broad sense. Minute teeth present in the ectopterygoid and the anterior part of the maxilla at the inner border of the teeth. Foramen pterygoideum located more forwards. Teeth sharply pointed and striated.

Description: The specimen shown in Fig. 6 (p. 196) represents the anterior part before the orbit of the right side of the skull. The median side is much damaged so that the suture between the maxilla and the nasal can not be detected. Part of the bone posterior to the weak constriction between the premaxilla and maxilla is lost. Its connection with the main part of the maxilla is reconstructed and thus hypothetical. In ventral view

the lateral border of the sub-orbital opening is shown. The suture between the maxilla and the ectopterygoid posterior to the sub-orbital opening is clearly indicated. The bone is light yellow in coloration. The surface of the bone is rather finely scultured. The fossilization of the bone suggests that the bone is not derived from lacustrine deposits. The alveoli is partly filled by fine greenish grey sands.

The preserved part indicates a crocodile with a slender and long snout. There is no notch formed behind the first canine like tooth but only marked by a faint constriction. Only the anterior border of the orbit is preserved. It is impossible to get the outline of it. Nevertheless, it shows that the anterior border is rounded without anterior extension as in the case of *Tomistoma*. In addition, the present specimen is characterised by unusual great number of alveoli. There are thirteen teeth or alveoli in the part before the plaster reconstruction and twenty five such in the posterior of the specimen. There must be at least one tooth at the anterior broken end and probably three to four in the missing part. Considering that the tooth row extends backwards to the level of the middle point of the orbit in most of the genera of Crocodilidae, there are at least seven to eight teeth missing in the posterior part of the present specimen. It is there fore, the total number of the teeth of our form is estimated about 14+3—4+25+7—8=49—51. (In *Tomistoma sohlegeli* about 30). Even considering half of the alveoli are those of the substitute teeth, the number of the functional teeth is estimated about 25±. So far as I know no other crocodiles have such great number of teeth.

Most of the teeth are represented by alveoli, only seven more or less well presented teeth are actually preserved. There are five teeth anterior to the large canine like tooth. The only completely preserved tooth of this region is sharply pointed and striated. As indicated by the alveoli of this part those teeth increase in size posteriorly. The alveolar of the canine-like tooth is nearly two times larger than that of the anterior one. Following this tooth there are eight alveoli with the fifth teeth actually preserved. It is small. All those teeth or the alveoli are closely situated and well rounded. The twenty five teeth of the main part of the maxilla are mostly represented by alveoli, only five more or less well preserved teeth. They are also closely situated. Nevertheless they are well separated by transversal bone ridge and much more transversally elongated in contrary to the anterior teeth. The first five or six teeth are comparatively small and then increase in size posteriorly. The last few teeth are somewhat smaller.

Another interesting feature of the specimen is that there are two rows of small minute teeth developed at the median side of the ectopterygoid. Three actual teeth are preserved and the others are represented by pited alveoli only. At the median side of the anterior part maxilla, faint indication of the presence of such teeth is observable. In no other crocodiles such feature is positively observed. Two rows of minute teeth have been observed by Yeh (1958) in *Tomistoma petrolica* from Maoming at the anterior part of the mold of the skull. It is probable that such teeth may also be developed in the posterior part of the skull in such form.

Measurements (in milimeters)

Length from the anterior border of the orbit to the anterior breakage of the premaxilla	204
Anterior maximum breadth before the constriction	13
Posterior breadth 25 mm before the orbit	41
Breadth from the median line to the inner border of the orbit	18
Length and breadth of the alveole of the canine-like tooth	5.5 × 5

Determination and discussion:

Although the specimen of Inner Mongolia is poorly preserved, but several characteristic points of the specimen show clearly that we have to deal with a new type of Tomistominae. The general shape of the snout part before the orbit is very similar to that of the recent *Tomistoma*. Unfortunately, it is impossible to detect the suture of the nasals. The present specimen is characterized by two features. One is the increasing number of teeth. The other is the presence of the minute teeth on the palatinal part of the skull. The latter feature is also observed in the cast of *Tomistoma petrolica* from Maoming, Kwangtung of Eocene age (Yeh, 1958, Plate I, fig. 2). In our form such teeth are not only found in the ectopterygoid but also in the anterior part of the maxilla, about the same location of the posterior part of the so-called X-shaped arrangement of the minute teeth (Ibid, p. 239, in Chinese text). It is probably that such development is commonly found in the genera of Tomistominae.

According to the field etiquette, the specimen is derived from the upper part of Lower Cretaceous (Cr.$_1^4$). Since the oldest record of Tomistominae are Upper Cretaceous, our specimen may either represents the oldest known of this sub-family or the geological age of it may be somewhat younger. The incompleteness of the specimen does not allowed to give a definite conclusion.

In any way, it is clear that the present specimen represents a new form of Tomistominae for which the name *Eotomistoma multidentata,* gen. et sp. nov. is proposed. The generic name indicates the older age of the specimen and the specific name the great number of the teeth. Its diagnosis is already given above.

This is the second record of Tomistominae found in China but with older geological age.

NOTE ON THE COPROLITES OF CROCODILES FROM NANHSIUNG KWANGTUNG

With the exception of the only piece of coprolite from 6218 all the coprolites (22 in number) are found from 6227 in association with *Asiatosuchus nanlingensis* described above. In the former locality remains of *Eoalligator chunyii* were found in association. In both localities, no other vertebrate are known, so that it is reasonably certain that all the coprolites described here are produced by their associated animals respectively.

The coprolites are varying in size from 45 mm to 115 mm long. They are generally slightly flatted and curved with more or less distinct tapered ends. A few of them are figured in plate I and II. Most of the surface of the coprolites are smooth but twig marks are occasionly preserved. In most cases sphincter-pinched marks during excretion are clearly observable (plate I, D.) which should be distinguished from the other marks. In some of the specimens gas cavities can be clearly observed especially on the surface of cleavage but not quite common. All the coprolites under study are apparently pure dungs without impurity except one figure in plate II C which is mixed with some pebbles. It is also more flattened. Due probably to the degree of weathering, some of them are compact and heavy and some are soft and light.

Thanks to the chemical laboratory of the Geological Institute, Academia Sinica, chemical analysis of the coprolites of 6227 has been made. It contains rather high percentage of phosphorus pentovide (P_2O_5, 11.35%).

Only in few cases bone remains or impressions of the same have been observed (Plate II, C. on the other side).

Comparing the coprolites of Nanhsiung with the dungs produced by the recent *Alligator sinensis* of the Zoological Park of Peking, they are very similar each other. (Pl. I, A) Although the dung of the recent form may be made by a young individual and also may effected by the artificial treatment but it shows the same weakly compressed, curved cylinderical mass. It is marked by more striations and more slender.

Recently, Jepsen (1963) has described some coprolites from the Golden Valley Formation of Western North Dakota, U. S. A. Judged by the given pictures and the description they agree in general features and size. The coprolites of Dakota are Eocene in age and thus somewhat younger than those of ours. According to Jepsen the Dakota coprolites pertained to large carnivorous reptiles and according to the fossil list given by the same author remains of crocodilidae are richly represented in the formation in four different forms. In our case, as noted above, both localities yield rich remains of crocodiles and so far no other vertebrate is recorded. It may be safe to conclude that the crocodiles are alone responsible for those coprolites. Of course we have different crocodiles in both localities. It is very likely that it is impossible to distinguish the genera and species from coprolites.

The occurence of coprolites of crocodiles in Nanhsiung is very interesting. It is for the first time that coprolites of reptiles are recorded in China. Recently coprolites of carnivorous mammals have been described by Fu-tsing Kao (1962). They are quite different from those of ours.

A REVIEW OF CROCODILIANS IN CHINA

With the various forms of crocodiles described by different authors since my paper

Age	Fossils	Region
Eocene	*Asiatosuchus grangeri* Mook	Irdin Manha, Inner Mongolia
	Lianghusuchus hengyangensis Young	Hengyang, Hunan
	Tienosuchus hsiangi Young	Hengyang, Hunan
	Tomistoma petrolica Yeh	Nanhsiung, Kwangtung
Paleocene	*Asiatosuchus nanlingensis* sp. nov.	Nanhsiung, Kwangtung
	Eoalligator chunyii gen. et sp. nov.	Nanhsiung, Kwangtung
Upper Cretaceous	*Shamosuchus djadochtaensis* Mook(*)	Djadochta, Mongolia
	Paralligator gradilifrons Konjukova(*)	Mongolia
	Paralligator ancestralis Konjukova(*)	Mongolia
	Paralligator sungaricus Sun	Tehui, Kirin
	Chiayuesuchus cingulatus Bohlin	Chiayuekuan, Kansu
	Eotomistoma multidentata gen. et sp. nov.	Ikechaomeng, Inner Mongolia
Jurassic	*Hsisosuchus chungkingensis* Young & Chow	Chungking, Szechuan
	Shantungosuchus chuhsienensis Young	Chuhsien, Shantung
	Sunosuchus miaoi Young	Haishihwan, Kansu
	Peipehsuchus teleorhinus Young	Peipeh etc. Szechuan
	Teleosaurus sp. Liu	Tatsu, Szechuan
Triassic	*Microchampsa scutata* Young	Lufeng, Yunnan

on fossils crocodiles in China 1948, and the present description of the new species here we are able to have a better understanding of fossil crocodiles in China now. The stratigraphical distribution of the so far known crocodiles may be given in the following list:

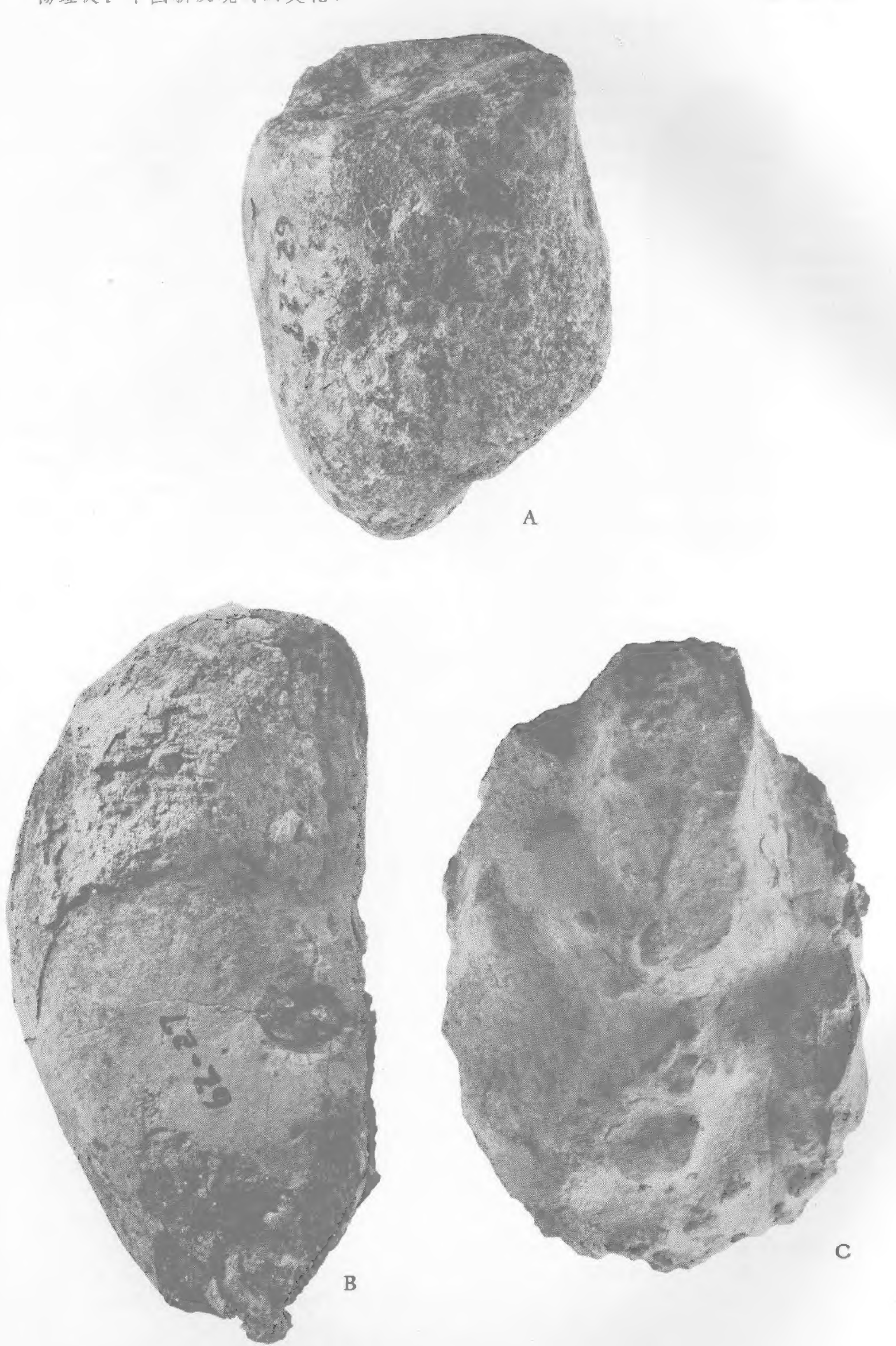
With the exception of the three forms of the upper Cretacenous described by mook and Konjukova (*), all quite near to the Chinese frontier and thus used for comparison, all the others are found in China. It is obvious that the forms of crocodiles are considerably increased during past few years. However, many of the forms are only represented by very fragmentary specimens and thus their validity can be questioned. It is possible that the so-called *Teleosaurus* sp. from Tatsu described by Liu may belong to *Peipehsuchus teleorhinus* or the *vice versa,* since they were derived from the same level.

Curious enough no fossil crocodiles have been recorded in China since Oligocene, although the faunas post of Eocene are fairly known in this country. The fossil alligations are recorded in Pliocene deposits Europe (Huene, 1963). The wide distribution of crocodiles in Jurassic, Createaceous, Plaeocene and Eocene time is also remarkable. As we know, presence of crocodiles indicate a warm and humid climate in the respective fauna.



图版 I. 图 A 北京动物园的一揚子鰐粪，两面視。
图 B–D 与南岭亚洲鰐同地发現的粪化石。均原大。

Plate I. Fig. A. Dropping of *Alligator sinensis* from the Zoological Garden of Peking in two views. Nat. Size.
Figs. B–D. Coprolites from locality 6227 in association with *Asiatosuchus nanlingensis*. All nat. size.



图版 II. 图 A-C 与南岭亚洲鳄同地发現之粪化石，均原大。

Plate II. Figs. A-C. Coprolites from locality 6227 in association with *Asiatosuchus nanlingensis*. All nat size.